What is claimed is:

1. An apparatus for providing image stabilization for a high-performance optical system, comprising:

a heating element arranged on an upper surface of a housing of the optical system to provide heat into one or more gas-filled spaces between lens elements of the optical system; and

an insulating layer arranged over at least a portion of the housing and arranged to facilitate the heating of gas present within the one or more spaces to create a stable thermal environment within the optical system.

2. An apparatus according to claim 1, further including a gas manifold arranged adjacent a lower surface of the housing to flow gas around the lower surface in order to prevent heating of the lower surface.

3. An apparatus according to claim 2, wherein the gas manifold is designed to flow gas around one or more heat-generating elements so as to prevent heat from the one or more heat generating elements from heating the lower surface of the housing.

4. An apparatus according to claim 1, further including a control unit electrically connected to the heating element for controlling the operation of the heating element.

5. An apparatus according to claim 4, further including an indicator light that indicates whether the heating element is activated.

6. An apparatus according to claim 1, wherein the electric heater supplies between about 1 and 50 Watts of power.

7. An apparatus according to claim 2, wherein the air manifold includes a hollow member having a plurality of apertures formed therein to provide for a distributed gas flow.

8. An apparatus according to claim 1, wherein the insulating layer includes a

blanket of Poron®.

9. An apparatus according to claim 4, further including an array of thermal sensors arranged over the housing and in electrical communication with the control unit, for providing temperature information about the housing to the control unit.

10. An apparatus according to claim 4, further including an array of thermal sensors arranged over the housing and in communication with the one or more spaces, and in electrical communication with the control unit, for providing temperature information about the gas in the gas-filled spaces to the control unit.

11. An apparatus according to claim 1, wherein the insulating layer covers the heating element.

12. An apparatus according to claim 1, wherein the gas in the gas-filled spaces is air.

13. A lithography system for patterning a wafer with an image of a mask, *comprising:*

a illumination system for irradiating the mask;

a microlithographic lens having one or more lens elements, and a housing for housing the lens elements and defining gas-filled spaces between the lens elements;

a heating element arranged on an upper surface of the housing to provide heat to one or more gas-filled spaces between lens elements of the optical system; and

an insulating layer arranged over at least a portion of the housing and arranged to facilitate the heating of gas present within the one or more gas-filled spaces to create a stable thermal environment within the one or more spaces; and

a wafer stage for supporting a wafer to be exposed with the mask image.

14. A system according to claim 13, wherein the gas in the gas-filled space is air.

15. An apparatus according to claim 13, further including an air manifold arranged adjacent a lower surface of the housing to flow a gas around the lower surface in order to prevent heating of the lower surface.

16. An apparatus according to claim 15, wherein the gas manifold is designed to flow gas around one or more heat-generating elements so as to prevent heat from the one or more heat generating elements from heating the lower surface of the housing.

17. An apparatus according to claim 13, further including a control unit electrically connected to the heating element and for controlling the operation of the heating element via an electrical current.

18. A method of stabilizing the imaging of a high-performance optical system subject to thermal instability, comprising:

heating the optical system so that gas in one or more gas-filled spaces of the optical system is heated so as to maintain a temperature differential within the one or more gas-filled spaces to form a stable thermal environment within the gas-filled spaces.

19. A method according to claim 18, wherein the heating is directed to an upper surface of the optical system to avoid convention thermal instability in the one or more gas-filled spaces.

20. A method according to claim 18, further including flowing gas over a lower portion of the optical system to prevent heat from heating the lower portion of the optical system.

21. A method according to claim 20, further including flowing gas over one or more heat-generating elements to prevent heat from the one or more heat-generating elements from heating the lower portion of the optical system.

22. A method according to claim 18, further including detecting image instability in the optical system.

23. A method according to claim 22, wherein detecting image stability includes measuring the temperature distribution of the optical system.

24. A method according to claim 22, wherein detecting imaging instability

includes measuring locations of images from the optical system at different times.

25. A method according to claim 24, including measuring overlay of between first and second level exposure fields.

26. A method according to claim 24, including using an aerial image monitor to measure the image locations.

27. A method according to claim 18, wherein the heating step is carried out such that magnification of the optical system is not significantly changed.